A NEW GUINEA FOSSIL MACROPODID (MARSUPIALIA) FROM THE MARINE PLIOCENE OF VICTORIA, AUSTRALIA

By M. Plane
Bureau of Mineral Resources

Abstract

The discovery of a fossil macropodid skull fragment in Lower Pliocene (Kalimnan) marine rocks with associated shelly and microfossils provides a further cornerstone in the development of a time scale for the terrestrial Tertiary sequence in Australia and New Guinea. The fossil is *Protemnodon otibandus* Plane 1967, a species previously known only from the non-marine Pliocene of New Guinea, but as a result of this study now recognized from Victoria and SE. Queensland.

Introduction

In April 1969 Mr R. E. Hesselschwerdt of Melbourne discovered in the second headland north of Lake Tyers House, on the Nowa Nowa arm of Lake Tyers, Victoria, a fragment of bone and portions of teeth. He carefully extracted a large block and presented it to the National Museum of Victoria (P26893). The block contained not only the skull fragment but an abundant shelly and microfauna. The rock in which the fossil was found is portion of the Jemmy's Point Formation which has been described as a lithologically diverse series of marine calcareous sands (Wilkins 1963). The upper shell bed in which the fossil was found has been dated by the same writer as lower Pliocene at the top of the Kalimnan Stage. As pointed out by Warren (1965) the formation contains rounded pebbles and carbonaceous material, which together with faunal evidence is taken as indicating a near shore environment. It is not surprising that a fragment of a terrestrial animal should be found in these rocks and indeed Warren (1965) has described a fossil marsupial humerus from this formation, at a site near the Bunga Creek road cutting on the Princes Highway, Victoria.

The fossil includes portions of the left maxilla, palatine and frontal bones, the complete left lacrimal, the four molar teeth, and the posterior alveolus of the permanent premolar. The molars are in the LMEB wear stage of Tedford (1966). The fossil, although fragile, has not been greatly damaged apart from one large crack which extends anterodorsally in the maxilla from in front of the M^3, through the anterior opening of the infraorbital canal and back to the lingual side of the M^3. There has been some compression along the path of the infraorbital canal, which has collapsed.

Description

Maxillary: The bone is robust and is pierced just anterior to the orbital rim by the anterior opening of the infraorbital canal. The maxillary is produced laterally above the M^3 to form a strong base for the anterior root of the zygoma. The maxillary contribution to the masseteric process of the zygoma has been broken off but it does seem certain that the jugal made a long contact with the maxillary; this contact terminated at the ventral edge of the lacrimal. The maxillary contributes to the orbital surface. The postorbital surface is pierced by the posterior opening of the infraorbital canal and a small sphenopalatine foramen is situated on the palatine/maxillary suture behind the infra-orbital foramen. Both foramina lie in a deep broad groove and are separated by a low ridge within the groove.

Lacrimal: From its shape and position this bone would seem to make up the anterodorsal section of the orbit. There is a large orbital process. The infralacrimal foramen is approximately twice the diameter of the supralacrimal foramen. They are separated by a small rugose infralacrimal tuberosity and there is no supralacrimal tuberosity.

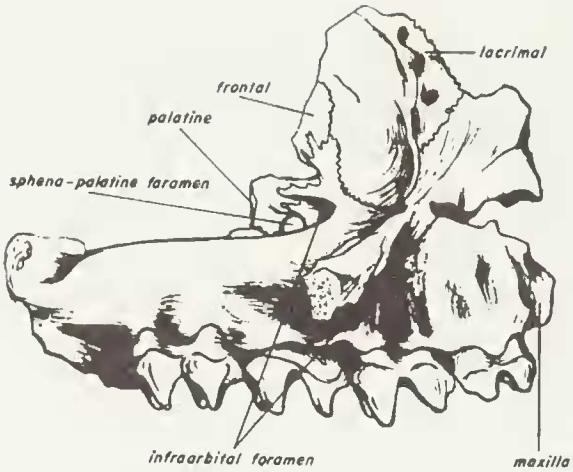

Fig. 1—Hypotype of *Protemnodon otibandus* Plane.

Frontal: Only a small fragment is preserved (Fig. 1).

Palatine: Only a small fragment is preserved (Fig. 1).

Dentition: The molars, as with those of all protemnodonts, are alike in pattern and shape. They are rectangular, low crowned, and strong. The protoloph is slightly narrower than the metaloph in M^{1-2} while in M^{3-4} the metaloph is narrower than the protoloph. A low anterior cingulum extends nearly across the tooth. From the anterolingual side of the tooth this cingulum is formed by a crest which ascends to a point just lingual of the anteroposterior midline of the tooth then levels off to a position anterior to the paracone. A spur which ascends from the top of the paracone meets the cingulum at the anterolabial corner of the tooth, and behind this junction a small pocket is formed. This is particularly noticeable on the M^{2-3} of this specimen. No forelink is recognizable and the anterior transverse valley between the cingulum and the protoloph is shallow. The midlink is low and formed nearly equally by the dorsal end of the post protoconal spur and the median metaloph spur. This is best seen on M^{3-4}. A spur ascends from behind the paracone to a point just below the top of the transverse median valley then inflects for a short distance to cross the valley and connect with a similar spur which ascends from the metacone. This structure, particularly the spur which ascends anteriorly from the paracone, is best developed in M^{1-2} but can still be seen in M^{3-4} while the other spur which ascends posteriorly from the metacone is reduced to a very thin line in M^{3-4}. The post paraconal and premetaconal spurs ascend to meet $\frac{1}{3}$ of the distance from the midline to the labial margin of the tooth in M^{1-2} while in M^{3-4} the premetaconal spurs are much weaker and become almost indistinct as they ascend into the transverse valley. A posterior spur ascends from the metacone and is separated by a slight commissure near the base of the tooth, from a sweeping spur which ascends dorsolabially from the hypocone. Stirton (1961) following Owen called this structure the hindlink. The posterior median spur on the metaloph is incipient on M^{3-4}, and M^{1-2} are too worn to show anything but the suggestion of a weak spur. The crests of the metaloph and protoloph are crescentic in occlusal view while in lateral view labial surfaces of the lophs of all molars tend to curve anteriorly.

Comparisons

On the completion of the preparation it was immediately apparent that the fossil was a protemnodont very like *Protemnodon otibandus* Plane 1967, from the Awe fauna of the Watut Valley, New Guinea. With the age of the fossil so firmly established relative to the marine sequence it was evident that the most meaningfull comparisons would be with Tertiary rather than Quaternary protemnodonts on the mainland. Mr Alan Bartholomai, Director of the Queensland Museum, made available to me the material from the Chinchilla Sand of the W. Darling Downs, SE. Queensland, and a striking resemblance to one of the species from that unit was apparent. Detailed comparisons were made with *P. otibandus* and the Chinchilla material which had been segregated under a new specific taxon. Morphologically the Victorian fossil can be matched in every feature with specimens from the Awe and Chinchilla faunas. The figured specimen of *P. otibandus,* U.C.M.P. 69857 (Plane 1967 fig. 7), a maxilla fragment with P^3M^{1-3}, was used in detailed comparisons with that species. While unfortunately there is no P^3 with the Victorian fossil it is clear from the worn nature of the anterior cingulum on the M^1 and the appression facet on the M^1 that this

tooth had contact with a P^3 similar to that observed in *P. otibandus*. The Awe maxilla is not as worn as the Victorian fossil and the postparaconal and premetaconal spurs are unworn in the Awe specimen. However, apart from variations attributable to wear, all morphologic features are identical. Chinchilla specimens used for comparisons were Queensland Museum numbers F4665, 4686, 4721, 4688, 4684, 4702. The length of the molars measured along the midline of the tooth listed in Table 1, illustrates that the Victorian fossil lies within the range of measurements made on Awe fauna specimens. Table 2 demonstrates that there is a greater narrowing of the metaloph on the M^{3-4} on the new fossil than that observed within the Awe specimens. The measurements made on the Chinchilla specimens are biased in that the smallest individuals had only anterior molars. The Victorian specimen is outside the range of the Chinchilla grouping.

The new specimen is assigned to the species *Protemnodon otibandus* and it is concluded that the Chinchilla assemblage also represent a population of the New Guinea species, albeit a slightly larger form.

Geochronologic Interpretation

The discovery of a land mammal in a marine formation with a shelly and microfauna is of great interest as it provides an independent check on the Tertiary non-marine time scale which has been built up by fossil mammal workers (Stirton, Tedford and Woodburne 1968).

The Upper shell bed of the Jemmy's Point Formation has been assigned a lower Pliocene age by Wilkins (1963) and he puts it as the top of the Kalimnan Stage. This then makes the new specimen of *Protemnodon otibandus* early Pliocene in the time terminology of the molluscan workers. The Otibanda formation and its associated Awe fauna are assigned a Pliocene age on the basis of radiometric dating (Plane 1967). A new date from higher in the section in the Watut Valley which is associated with the occurrence of *P. otibandus* extends the range of dates for the formation from 3·9 to 7·6 m.y. B.P. The age of the Chinchilla fauna is not precisely known. It has been assigned both an early Pleistocene (Stirton, Tedford and Woodburne 1968) and late Pliocene age (Woods 1960).

The discovery of the new fossil provides an opportunity to re-examine the age of the Awe and Chinchilla faunas. Recently, radiometric dating has been carried out by McDougall and Page (1970) in an attempt to develop a time-scale for the Miocene of New Guinea. They suggest that the Miocene, as recognized in the Indo-Pacific, extends from 22·5 to 5·5 m.y. before present. This and present concepts of the Pleistocene has reduced the Pliocene to a short interval spanning 2·5 m.y. using the base of the Pleistocene at about 3 m.y. B.P., and a Miocene/Pliocene boundary at 5·5 m.y. B.P. On this scale the Otibanda formation ranges from late Miocene to late Pliocene and the species *P. otibandus* is present throughout the Pliocene. The new specimen of *P. otibandus* from the Kalimnan stage (lower Pliocene) of Victoria lies well within this range.

No firm date can yet be assigned to the Chinchilla population of *P. otibandus*. The larger size of the animals might be construed as indicating a younger age but may well be due to environmental factors. The evidence does suggest, however, that the Chinchilla fauna is of Pliocene age as claimed by Woods (1960) and Bartholomai (in press).

TABLE 1

	Awe (composite)		Lake Tyers	Chinchilla (composite)	
M^1	10·0-11·5	(4)	10·2	10·7-11·5	(3)
M^2	11·7-12·8	(6)	12·5	13·1-14·4	(4)
M^3	12·9-13·9	(5)	13·0	14·2-15·5	(4)
M^4	13·1-14·0	(3)	13·5	15·7-16·4	(3)

Table 1: length of molars measured at the midline. The Awe and Chinchilla composites indicate the extremes.

TABLE 2

M^1	p 9·5-10·6	(4)	9·8	11·0-11·4	(3)
	m 10·6-11·0	(3)	10·0	11·7-11·9	(3)
M^2	p 10·3-12·4	(5)	11·5	12·6-13·7	(4)
	m 10·3-12·8	(6)	10·9	12·6-13·6	(4)
M^3	p 10·3-12·7	(5)	11·9	12·2-15·3	(4)
	m 11·7-12·5	(5)	10·7	11·9-12·9	(4)
M^4	p 12·4-13·1	(3)	11·7	13·0-13·2	(3)
	m 10·0-10·9	(3)	9·6	11·3-12·8	(3)

Table 2: width of protoloph and metaloph at base of enamel.
p = protoloph m = metaloph
(4) = number of individuals measured

Acknowledgements

* I am indebted to Prof. James Warren of Monash University who brought my attention to the fossil and to Mr T. A. Darragh, Curator of fossils, who kindly loaned it to me for study. This paper is submitted for publication with the permission of the Director of the Bureau of Mineral Resources.

References

BARTHOLOMAI, A. (in press). Aspects of the evolution of the Australian marsupials. *Proc. R. Soc. Qld.*

PAGE, R. W. and MCDOUGALL, I., 1970. Potassium-Argon dating of the Tertiary f_{1-2} Stage in New Guinea and its bearing on the Geological Time-scale. *Am. J. Sci.* 269: 321-342.

PLANE, M. D., 1967. Stratigraphy and vertebrate fauna of the Otibanda Formation, New Guinea. *Bull. Bur. Miner. Resour. Geol. Geophys. Aust.* 86: 1-64.

TEDFORD, R. H., 1966. A review of the macropodid genus *Sthenurus. Univ. Calif. Publs Geol. Sci.* 57: 1-72.

STIRTON, R. A., TEDFORD, R. H., and WOODBURNE, M. O., 1968. Australian Tertiary deposits containing terrestrial mammals. *Univ. Calif. Publs Geol. Sci.* 77: 1-30.

WARREN, J. W., 1965. Description of a fossil humerus (Marsupialia) from the lower Pliocene of Victoria, Australia. *Proc. R. Soc. Vict.* 79: 147-152.

WILKINS, R. W. T., 1963. Relationships between the Mitchellian, Cheltenhamian, and Kalimnan Stages in the Australian Tertiary. *Proc. R. Soc. Vict.* 76: 39-59.

WOODS, J. T., 1960. Fossiliferous fluviatile and cave deposits. In Hill, D., and Denmead, A. K., Editors, The geology of Queensland. *J. geol. Soc. Aust.* 7: 393-403.